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Immersive Virtual Field Trips: Reflection on Exploration, Development, and Application

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Immersive Virtual Field Trips: Reflection on Exploration, Development, and Application

by

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Report

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Abstract

Immersive Virtual Field Trips: Reflection on Exploration, Development, and Application

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The purpose of this report is to explore the research and the development process of virtual field trip experiences through the creation of a 360 degree virtual field trip. Virtual field trips are emerging learning experiences that are being created to provide students access to locations and areas that might have been inaccessible in the past due to factors such as funding, student location, and safety. With the COVID-19 pandemic impacting education and learning experiences across our world, the importance of digital learning and access to quality virtual leaning has become even more important. Virtual field trips provide students with interactive virtual tours that can be enabled to be viewed as a fully immersive virtual reality experience. The virtual field trip created for this report is a tour of a dry underground cave that will serve as an example of the types of experiences that can be created to support classroom learning. The report introduces virtual field trips, describes the development process, explores the possible impact on creators and viewers, and discusses the limitations of this report and implications of integrating virtual field trips in education.

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Introduction

Virtual field trips are an emerging type of learning experience appearing in the spaces of education and professional training (Almenara & Robles, 2018). Such field trips are generally videos or a collection of images that are sequenced to provide an alternative experience similar to in-person tours and training. Research has identified positive impacts on student learning from using immersive virtual field trips, such as knowledge retention, knowledge transfer, motivation, development of fieldwork skills, development of special skills, and academic performance (Almenara & Robles, 2018; Klippel, Zhao, Oprean, et al., 2019; Klippel, Zhao, Jackson, et al., 2019; Merchant et al., 2014; Moran & Woodall, 2019; Stainfield et al., 2000). When students visit sites or watch experts perform tasks to learn from real world applications virtually, they have the ability to move around, look at objects from different angles, and take a closer look to acquire knowledge and understanding of the real world. Virtual field trips provide an experience analogous to in-person engagement that allows learners to acquire the same type of knowledge and understanding as if they were present in the actual physical space.

The creation of virtual field trips can look different depending on the equipment and software available and the purpose of the experience. In the early years of virtual reality creation, creators would use the process of image stitching to create panoramic images as well as cylindrical and spherical images that provide a 360 viewing experience (Lyu et al., 2019). Image stitching is the process of overlapping images and videos to generate a wide field of vision image or video (Lyu et al., 2019). The process of image stitching can be tedious and requires technical training and expertise but, with recent developments in technology, 360 degree cameras with special algorithms that stitch these images automatically are now available and have made it

easier for creators and educators to design, record, and develop these types of experiences (Lyu et al., 2019). These cameras and new software have eliminated the stitching process and have decreased the learning curve of editing and implementing these types of experiences, allowing educators to take produce and control the experiences they would like to deliver to students.

Creating and using virtual field trips for educational purposes provides students access to experiences that might not have been available to them before. In 2018, I had the opportunity to attend the Games for Change conference that was produced in collaboration with The Parsons School of Design at The New School in New York City. At this conference, attendees had the opportunity to visit different booths to learn and experience the different types of technologies that had been developed by different organizations. This is where I believe I experienced the first 360 virtual experience that made an impact on my learning and sparked my interest in creating these types of experiences. The booth I visited had created fully immersive virtual field trips using 360 cameras to teach people about the impact of natural disasters. The experience I chose to watch was one about wildfires. The way the group created the video was by mounting 360 cameras on a helicopter used to drop thousands of gallons of water on raging wildfires. The virtual field trip also allowed the viewer to experience what it looks like to be in a forest as the fires approach and what the forest looks like after it had been charred by the fires. I have read about wildfires before and I've seen videos of wildfires before on the news and social media, but none of them had such a large and lasting impact as the virtual experience at that conference booth. I would have never had the opportunity to experience that unless I had become a firefighter, a helicopter pilot, or had some sort of special access to accompany someone and be around a dangerous area such as this one.

While this example might be a bit intense, I began to think about all the different types of experiences that could be created for students that would give them access to knowledge and real world phenomena that are currently inaccessible to them due to a variety of factors. Unfortunately, digital inequity exists in schools across our nation due to factors such as funding, location of the school, and access to technologies (Hohlfeld et al., 2017). While some students might have the resources, access, and opportunity to travel to different locations and learn from experts in the field, other students only have access to the experts and locations in the surrounding area of their school. Virtual field trips offer a way to help combat inequities in education by providing students learning experiences accessible from devices already available to them such as computers, tablets, and phones (Burztyn et al., 2017). Through my knowledge of video production and instructional design, I decided to create a 360 virtual experience of my own to explore the development process and possible applications of these types of experiences.

Educators and students can benefit from incorporating virtual field trips into teaching and learning. Before educators begin to design, develop, and implement these types of experiences for their students, it is important for them to have a better understanding of a development process to create these videos as well as the impacts on students and the possible applications of these types of technologies in their teaching.

The following is the virtual field trip created for this report:

Wonder Cave Immersive Virtual Field Trip:

https://www.youtube.com/watch?v=G1S_TIZNexM

Virtual Field Trip Production Process

Location Selection and Purpose of Experience

At the start of this project, there were two different locations that I was considering for the creation of the virtual field trip for this report. The first option was the Umlauf Sculpture Garden and Museum located in Austin, Texas and the second option was the Wonder Cave located at Wonderworld Park in San Marcos, Texas. When creating 360 videos, there are a couple of factors that should be considered to have a successful recording session and virtual field trip development. Some of these factors include: ambient noise, lighting, access to location, permissions to film or take pictures, and available resources or expertise on the location you are trying to record and teach about. In addition to these factors, it is also important to think about the overall experience, key take-aways, and goals you would like viewers to achieve to determine if the recording of the location is aligned to those areas.

While both of the locations would have been suitable for this report, I selected the cave tour because I believed that viewers would have a better overall experience from watching the 360 video and a virtual field trip of a cave would be an interesting example to integrate it into a course curriculum. The cave virtual field trip would allow the user to look and explore the entire cave surrounding them while the sculpture garden would only be focusing on one fixed object, the sculpture in front of them. In addition to this, I decided to create the virtual field trip of the cave because of my prior knowledge and interest in science topics.

List of Equipment Used

The following is a list of the different equipment and software used to record, produce, and view this virtual field trip experience:

Devices

- Insta360 One R Camera
- MacBook Pro (2017)
- iPhone X

Tools

- Action Camera Head Mount
- VR Headset for Mobile Devices

Software

- Adobe Premier
- Photoshop
- GarageBand
- Microsoft Word

Site Visit, Note Taking, and Recording

The number of visits to the site selected for the virtual experience can vary due to factors such as previous experience, weather, availability of equipment, and expertise or knowledge of the site. For this virtual experience, I first ran test recording sessions off site, to test equipment and video quality since it was my first time using the Insta 360 One R camera for recording. Since the location for this virtual field trip was in an underground cave, factors such as weather and lighting were not an issue when determining when to record at the site and how many visits

to the site were necessary. The site visit had to be conducted during business hours and during a time when a tour guide was available to provide the content that would be used in the video voiceover, since I was not the subject matter expert. I booked my tour and made sure that photography and recording during the tour was allowed. I decided that I would only need one site visit to record and this virtual field trip.

The site visit and recording session took place on September 25th, 2020. The 360 camera was mounted on the top of my head using an action camera head mount and I recorded and took stills of several rooms as well as movements where we would walk from one location to another throughout the tour. As I toured the cave, I recorded explanations of some of the rooms and took notes on my mobile device that would help me develop the voiceover script for my 360 video. The tour lasted about an hour and a half and I learned more about caves, such as what are dry caves and how are they formed and what different types of rocks can be found in caves like this one. Throughout the hour and a half tour, I gathered all the video footage and information I needed to create my virtual field trip.

Video Footage Review, Experience Outline, and Script Creation

Once I got back to my office, it was time to review the footage and create both an outline for the video and the voiceover script. I transferred all the video from the camera on to an external hard drive and watched all the different recordings I obtained. While lighting was not a factor in how many times I visited the cave, it was a factor in the quality of footage that was captured for the video. I determined which areas of the cave had the best quality footage and selected which areas throughout the cave were going to be included in the video. There were six major areas in the cave, and I selected three to be included in my video. These areas were: The

Grand Hallway, the room located right under that hallway, and The Well Room. These rooms were selected for my virtual fieldtrip because of the quality of video and stills captured, the information discussed in during the tour, and the objects available to see and learn about in each room.

After I selected these three areas, it was time to review voice recordings and my notes to plan out the sequence of the videos and stills, and create the voiceover script for the virtual field trip. I selected pieces of information that would be interesting to viewers and that I knew I could point to or signal to in order to guide viewers' attention. After I selected the information, I created a voiceover script that would be used as the narration throughout the virtual field trip. I identified areas within the script where I would use signals such as circles, arrows, and text to capture the viewer's attention. These areas were selected to be signaled because they are the objects of focus in the virtual field trip experience. Identifying these areas on the script are an important part of planning the experience because it helps with the alignment of visuals you would like to see appear on the screen with the audio viewers are listening to. In addition to signals, I also identified areas where external media, such as pictures or maps, might be good to include to prompt better learning and a deeper understanding of the information the voiceover was describing. The script has highlighted sections of areas that were identified as places to include either a signal or external media in the video. Sections highlighted in yellow are places where signals will be used the video and sections highlighted in green are places where external media will be included to support the voiceover. A complete voiceover script along with these highlighted sections is located in the Appendix of this report.

Voiceover Recording

Once my voiceover script was finalized (see Appendix), it was time to record the audio. Audio recording can be done using microphones and software already available on many of the devices we use. For this project, I decided to use the internal microphone on my Mac laptop and used GarageBand to record and edit the audio. For the best quality audio, I recorded in a quiet space that had no echo. As I recorded, I listened to the audio over and over and identified any areas that needed revision. It is much easier to identify and correct any mistakes during the initial recording session because attempting to correct audio in a different recording session can cause the audio pieces to not match one another. Once the voiceover audio was completed and finalized, it was exported as one audio file to be used during the video editing process.

Video Editing

Video editing for 360 videos can be done with a variety of software. For this project, I chose to use Adobe Premier because it provides some capabilities that other software do not, including: video transitions, 360 video previewing before export, video editing in the 360 viewing mode, and easy import and use of the file types created by the 360 camera that I was using. An alternative to this software that could offer similar capabilities is DaVinci Resolve, a free video editing software. I imported my video and audio files into Adobe Premier and began to build the experience. When creating videos using a voiceover audio, I have found it easier to start with the audio on the editing timeline and add video and other visuals on top of the voiceover. Doing this provides better alignment between what is being said in the video with what is being seen on the screen.

Editing 360 videos has similarities and differences to editing regular videos. As you edit 360 videos, you have to toggle between a panoramic view to edit and a spherical view to preview what you are creating. Throughout the video editing process, I exported portions of the experience and tested uploads to YouTube to make sure the platform was correctly recognizing the video as a 360 experience and to check the quality of the video. Once all of the video was placed on the timeline and was correctly aligned to the voiceover, video transitions, music, signals, text, and additional images were added into the video to enhance the overall viewing experience and guide viewers' attention throughout the video. Once the first draft of the video was complete, I exported and uploaded it to YouTube, and sent it out to my supervisor and reviewer for a first round of feedback.

User Testing, Feedback, and Revisions

My supervisor and reviewer for this report watched the video and provided feedback. In addition to this, peers also tested the virtual reality experience using a mobile phone with a pair of VR goggles and provided feedback. Once piece of feedback I received was that the video needed additional signals to help viewers know where they should be looking. The first draft of the video used an arrow, a circle, and text to signal the object that was being talked about. Unfortunately, if the viewer was not looking in that direction, they would not see these signals pop up on the screen. To correct this, additional signals were placed to tell viewers to look left, right, up, or down, to find the objects being discussed.

Another piece of feedback I received was to provide viewers with a note about cave rules. Since the cave used for my virtual experience is a dry cave, all rock formations could be touched through the tour. This is not the case for many other caves however, so it was determined to be

important to include some sort of note or messaging to prevent viewers from making mistakes if they ever visit a cave in the future where touching rock formations is not allowed. To address this feedback, I added a note during the video to remind viewers to always ask their tour guide about the cave rules before touching formations.

The final piece of feedback received was to fix a map in the video that shows the Balcones fault line. The initial map only showed the Balcones fault line as it goes from north to south Texas while the audio states the Balcones fault line runs from southern Oklahoma to central Mexico. To address this feedback, I corrected the map to include the sections of the Balcones fault line that go into Oklahoma and Mexico.

Final Export

Once the video was edited to address the feedback I received, I exported the final video and uploaded it to my YouTube channel. In addition to this, I made sure to include any attributions for music or visuals in the videos description to give proper credit. This is important because failing to do this can result in the removal of your video from the platform. Once the upload finishes uploading and processing, which can take a while depending on the length of your experience, the video is ready to be distributed and viewed on computers, tables, phones, and VR goggles.

Learning Through Creating: Project Objectives

360 Video and virtual reality experiences are an interest of mine that I continue to develop. Before this project, I created a video series called “VR Together” that aimed to introduce educators to 360 video technologies, the process of recording using these technologies, and provide guidance on how this can be implemented in their classrooms. Virtual reality technologies are still new to me and that series was a way for me to share and teach others as I learned about these technologies. For this report, I wanted to take the next step and apply what I had learned about 360 video production and create an actual virtual field trip of a site that was more applicable to support teaching of a specific subject.

At the beginning of this project, I set two main objectives for myself to achieve. My first objective was to further my skills and knowledge of 360 video production and immersive experiences through the development of this 360 virtual field trip. Previous to this virtual field trip, the only other 360 video I had created before was a tour of a local park that was created to provide an example of what 360 videos and virtual field trips could look like. There was way more involved for cave tour since I had to go out, record in an underground setting, learn from a subject matter expert, develop a script that would be interesting, informational, and engaging, and overall create a virtual reality experience that would be close to the in-person experience viewers would receive if they were actually in the cave.

As I worked on developing this experience, I gained knowledge and skill relative to creating virtual field trips. I learned about how to compress a long tour into a smaller experience while guiding viewers' attention and learning throughout the virtual field trip

using strategies such as segmenting, signaling, weeding, and synchronizing (Mayer & Moreno, 2003). I learned how to use a new 360 camera that allowed me to provide higher quality video and images through research and watching online tutorials on YouTube. I also learned how to use a new, more sophisticated, editing software for 360 videos known as Adobe Premier, which provided a wider range of capabilities than the previous software I was using. Now having completed the virtual field trip, viewing it myself, and receiving feedback on it, I learned about potential strategies that can be used to enhance future virtual field trip developments. One of these strategies would be to not only narrate the video, but also be present in the video to better guide students' attention throughout the virtual field trip and have better alignment to the in-person experience. Other strategies include providing more multimedia within videos to deepen viewers understanding and integrating more activities and engagement.

In addition to possible strategies for future virtual field trips, I also learned about communicating learning through virtual fieldtrips and have a better understanding of cave systems like the one I visited. Like with any type of video, it is important to be clear and concise as well as speak at a good speed to create videos that retain viewers' attention and eliminate confusion or moments that could be perceived as boring or too long (Shoufan, 2019). The real field trip experience lasted over an hour, which would be really long for students to watch as an immersive experience. Instead, as I read my notes, listened to the audio, and worked on my script, I learned that shortening the content that was being delivered into smaller chunks of information would be easier to understand and retain for viewers. The cave I explored for this virtual fieldtrip, was the first dry cave I had visited.

In the past I have visited caves that had formations such as stalagmites and stalactites, but never a cave that was completely dry and where you were allowed to touch everything around you. It was really interesting to learn about the Balcones Fault line, the earthquake that created this cave system, and how people would use this cave system in the past to collect water.

The second objective I set for myself was to develop a virtual field trip experience that would give educators a more practical example of what they could create themselves to integrate and support their curriculum. While the previous example of my park tour (https://www.youtube.com/watch?v=B0dcYcufAq8), gave educators a feeling of what 360 video is, the cave virtual field trip provides educators a better example of how students would learn by viewing these types of field trips. I created the cave tour as a virtual field trip that could support a geoscience course or a general science course, depending on the grade level. This virtual field trip teaches viewers about how caves are created, fault lines, different rock formations, what lives or lived in cave environments such as this one, and the history of the cave. While this virtual field has just recently been finalized and not distributed to teachers for feedback, I believe that this video will give educators a better idea of how virtual field trips can support student teaching.

Potential Objectives and Learning Outcomes for Educators

A major takeaway that I hope educators take from experiencing the virtual field trip and learning about the 360 video production process, is that anyone can do it and you don't have to be an expert in these technologies to create these experiences for students. When educators become the creators of these experiences, I anticipate that they will have their own set of objectives and learning outcomes they will achieve. I believe that educators will identify the strengths and benefits of building and using immersive virtual field trips and be positively impacted and motivated about these technologies, as experienced by pre-service students who learned and created 360 virtual field trips as part of their program (Huh, 2020). In addition to this, educators will experience the control they have to guide the learning and tailor the experience for their students and will potentially come out of the experience understanding that creating immersive virtual field trips, has a lower barrier and provides more flexibility to design and implement these types of activities in their own classrooms (Brown & Green, 2016). Finally, after experiencing the production process for themselves, educators will be able to identify the differences between immersive and non-immersive experiences as well as identify other locations and virtual experiences that they might have access to where they can create a virtual field trip, that students might not have access to because the location is inaccessible to them, it is too dangerous, or might be too expensive to visit (Wallgrün et al., 2017).

As educators become creators and improve their skills, I can also potentially see them becoming motivated to venture out and see what other types of 360 videos or immersive experiences they can create. There are a lot of free or very low cost software

available for creators (Wallgrün et al., 2017), and it's possible some educators might be motivated to try them. Klippel, Zhao, Oprean, et al. (2019) developed a taxonomy of immersive virtual field trips that categorizes experiences as basic, plus, or advanced where basic would a virtual replication of a traditional experience, plus would be all features of the basic experience plus opportunities for new spatial perspectives such as a birds eye view or site-by-site comparison of specially distant outcrops, and advanced would allow for additional simulation features such as observing changes over time or collaborating with others. The categorization for this virtual field trip experience would be a basic experience based on this taxonomy but I myself am interested in learning more about creating plus and advanced experiences. As teachers become more comfortable with their skills and continue to create more virtual field trips, it is possible for them to set an objective for themselves to try new technologies and work their way up this taxonomy.

In addition to having objectives and achieving learning outcomes as creators, I anticipate educators will also have objectives and learning outcomes as they implement these experiences in their classrooms. A major objective I see for educators that decide on using virtual field trips would be to be able to identify the affordances and benefits that can be provided by these experiences for students. As mentioned before, research has shown that there are many positive impacts on student learning from using immersive virtual field trips, such as knowledge retention, knowledge transfer, motivation, development of fieldwork skills, development of special skills, and academic performance (Almenara & Robles, 2018; Klippel, Zhao, Oprean, et al., 2019; Klippel, Zhao, Jackson, et al., 2019; Merchant et al., 2014; Moran & Woodall, 2019; Stainfield et al., 2000). Further, Di Natale

et al. (2020) identified affordances of immersive virtual field trips to include development of spatial knowledge representation, experiential learning, intrinsic motivation and engagement, and transfer of knowledge. As educators implement these experiences and observe students, the benefits and affordances impacting their students will become visible.

In addition to identifying benefits and affordances, I believe educators will also have the objective of creating and implementing these experiences with little to no cost and trying to use the devices and resources that are already available to them and their students. Not only is creating these experiences low cost by using off-the-shelf technologies, but it is also low cost to implement (Klippel, Zhao, Oprean, et al., 2019; Wallgrün et al., 2017). With advances in technology, the cost for 360 cameras, which can range from $160-$350 for an off-the-shelf camera, have gone down allowing more educators to request a device or purchase a personal device to create these types of experiences. For implementation, non-immersive viewing can occur on laptops, tablets, and phones that schools already provide or students own. Immersive experiences only require head mounts that work with mobile devices that are available for a low cost, $5-$15 per headset, which is definitely much lower than taking a whole class to an actual field trip. Once educators purchase these virtual reality head mounts, they can continue to use them year after year, eliminating the cost to access these sites after the first year.

Given the fact that educators teach different grade levels and courses, and will come into this experience with different technology skill levels, additional objectives and learning outcomes can exist that are simpler or more complex than the ones stated.

Overall, I hope that the experience of developing and implementing virtual field trips inspires educators to try new and exciting non-traditional methods of teaching to enhance students overall learning experience.

Limitations

One of the limitations of this report is the lack of data on the actual learning impact on viewers of this virtual field trip I created. The report is focused around creating an impactful learning experience through the planning, production, and possible application of the virtual fieldtrip based on research findings, but due to the early stages of the creation of the experience and release, no data or feedback from viewers is available to measure actual impact of the Wonder Cave virtual field trip. A possible next step for this virtual field trip experience, is to monitor video analytics and collect feedback via the comments, social media, and surveys.

Another limitation that is present in this report is the limited access to information about the Wonder Cave. Since I am not a geological subject matter expert, I was limited to the information collected from our tour guide or that was available online about the Wonder Cave. As a result, certain areas of the cave or pieces of information had to be excluded from the experience due to the lack of explanation given by the tour guide or available information online. For future virtual field trip productions, working with more than one expert and meeting or communicating with these experts apart from the tour might provide me with deeper understanding of subject I am trying to teach about and would allow me as a creator to build a better learning experience for viewers.

Implications and Conclusion

This virtual field trip and project was finalized and approved in December 2020, and the video was published on my YouTube channel at https://www.youtube.com/channel/UCfUWir7B42Opmpx6n1nwqoQ and distributed on social media platforms. My hopes for this virtual field trip are for teachers to integrate it into their curriculum and use it as a learning activity in their classrooms, whether it be in an in-person course or a distance learning course. I also hope that this experience sparks curiosity and inspires other educators to learn more about 360 video production and maybe even watch my first video series called VR Together that can be accessed at the following link: https://www.youtube.com/playlist?list=PLdm3KC6lyZnh-IdNTI0C86c6PH8nCX3jV, to learn and create their own virtual field trips. Looking toward the future, I plan on creating a library of virtual field trips on my YouTube channel that would be available for educators to use in their instruction. In addition to this, I have also been thinking about creating complete lessons and activities that align to grade level learning objectives and state standards for easier implementation and would invite teachers who use these virtual field trips to comment on the YouTube videos with how they used the videos and the standards it aligned with in their use. As I continue to develop my skills in immersive virtual field trip technologies, I plan to explore interactive immersive virtual field trips, mixed immersive experiences, and gamified virtual field trips and also share what I learn with other educators.

Appendix: Complete Voiceover Script

Color Coding Key:

Items to signal using arrow, circle, and text

Make external items such as pictures or text appear

Video Introduction and Instructions

Welcome to the Wonder Cave Virtual Field Trip. This video is a 360 interactive virtual experience. If you are viewing the video on your computer, tablet, or phone, you can use your mouse or finger to move the screen in any direction during the video. You can also have an immersive experience by using a VR headset and enabling the VR mode. Get ready to enter, The Wonder Cave.

Entering the cave

Hi there, my name is Raul and I will be your guide throughout this virtual field trip. We are currently walking into the cave to get to our first stop of the tour. Look around and explore the cave as we walk deeper and deeper below the surface. The cave you are entering is the Wonder Cave, located at Wonder World Park, in San Marcos, TX. It was found in the late 1800s, early 1900s and is now a cave that can be toured every day of the week.

Room #1: The Grand Hallway

We have arrived to the first room of the cave. This area is known as the Grand Hallway. It is named the grand hallway because it is exactly that, a huge hallway that leads you into different areas of the cave. The Wonder cave is a Dry Cave, meaning that there is no running water in the

cave and everything is pretty much dry. The cave was formed many years ago due to an earthquake along the Balcones fault line. A fault line is a break or fracture in the ground where tectonic plates move and earthquakes can occur. If you look up, you can see the Balcones fault line run straight down the middle of the grad hallway.

The Balcones fault line is one of the largest fault lines in North America. It runs from southern Oklahoma down into central Mexico. Along with it being one of the largest, it is also the one of most inactive fault lines, meaning there has not been any movement since the earthquake that created this cave and there is no expected movement for a very long time.

Since the cave was created by an earthquake, this means that the walls to your left and right are like puzzle pieces. If you notice the pattern on the left wall, the rock goes out, in, out and the pattern on the right side wall goes in out in. If they were brought together, they would fit into each other, just like to puzzle pieces. Every rock on one side of the wall has a counter side on the opposite wall.

In the grand hallway we can see different types of rocks. Here, we can see a type of rock known as a Turnt nodule, which is the premature form of flintstone. If these rocks were to receive more heat and pressure, they would turn into the black rock that we know today as flint rock, which was used to make things like arrow heads. Since they will not get the heat and pressure they need to turn into flint, these rocks will stay in their premature form.

If you look on the rock walls you might also see some green stuff. This green material is known as mossy lichen. Mossy lichen is a self-sustaining organism that feeds off of moisture and light, which makes this cave a perfect environment for it to live in. The mossy lichen can also feed off of the bacteria found on the human hand so if you were to touch the mossy lichen you would actually be feeding it.

I do want to quickly take you back to a rock that we passed up as we entered the cave. This rock right here is Flowstone rock. Now while this cave is a dry cave, this rock here is the only rock in this cave that has a constant flow of water going over it. The water on the rock is 98% pure water that is being filtered by 3 different types of limestone. The Jorge Town limestone, which is the most dense type of limestone in the cave, Buda limestone which is in the middle ground, kind of dense and kind of porous, and the third type, which we will see later in our tour, is the Edwards limestone, the most porous type of limestone the wonder cave.

Alright we have finished up exploring the grand hallway, and it is now time to go into our second room of our Tour.

Room #2

Welcome to the next stop of our virtual field trip. Let's start off by looking up at the ceiling of this room. This ceiling will look different than all the other ceilings in the cave. This is because this ceiling is actually petrified sea mud. Texas was once under a shallow sea and this ceiling

was the very very bottom of that sea floor. A good example of this would be if you grabbed a fish bowl with sand and water, and looked at the bottom of the bowl.

In this room we can see a bit of flint rock surrounded by the bedrock. Here is a zoomed in image where you can see that a little clearer.

Another rock that you will find on the walls of this room is Gypsum. Gypsum is a white powdery rock that can easily be scratched by your fingernail. Some common uses for Gypsum are sheetrock and make-up.

Now, have you ever experienced absolute darkness? This is something that you can only experience in a cave like this one since there is no natural light inside. We are going to turn off the lights in this room to experience absolute darkness. Are you ready? The lights will be going out in 3, 2, 1.

This is absolute darkness. If it weren't for the sound of my voice you might have thought the video had stopped or your screen might have turned off. If you were in this cave right now and put your hand in front of your face, you would not be able to see it.

Let's turn the light back on.

Absolute darkness can be found in 3 places.

1) In caves just like this one

2) Down in the deep ocean were the giant squid lives, where sunlight is not able to reach

3) And in the outer reaches of outer space.

If you were to stay in absolute darkness some time, you can begin to experience severe vertigo. Meaning you wouldn't know what is up, what is down, what's is left, and what is right. If you were here for a long period of time, you would start to develop cataracts over your eyes because your eyes wouldn't be needed and you would go blind. You would have an extremely tough time finding your way out of a cave in absolute darkness.

Now, it's time to move on to our next and final stop on our tour, Let's go.

Room #3: The Well Room

Welcome to our third and final stop of our tour, The Well Room. We are currently 97 feet below the surface and it is the lowest point of this cave. This room is known as the well room because there is actually a well in the room that used to be used to gather water. As you can see, the original pulley system is still here from when people used to use it to collect water. Coming down to grab water from this well would take about 2 hours to do and people used to come down here using just candle light.

Here in this hallway we can see that third type of limestone rock that was mentioned earlier. This limestone rock is known as the Edwards limestone. It is named Edwards limestone because it lines the Edwards aquifer. Some people also refer to this type of rock as cave coral, because of its appearance. As mentioned before, this is the most porous type of rock found in this cave.

Alright, we have reached the end of our cave tour. I hope you have enjoyed exploring the Wonder Cave. If you are ever in the San Marcos, TX area. Stop by to learn more about the cave and explore other areas that were not in this tour.

Thanks for joining us on the Wonder Cave tour.

[END OF SCRIPT]

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